

**Homework 1**

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Due March 17

*Note 1: Discussion with others is encouraged.*

*Note 2: However, the final write-up and programs must be your own work.*

*(Copying of part or the whole of others' work and/or programs will be checked by the TAs and/or computer programs.)*

*Note 3: Homework should be submitted through KLMS and is due at midnight of the due date.*

*Note 4: You may use any programming language of your choice for programming.*

*(However, once you use one programming language, use the programming language and the same version throughout the semester.) When you submit programs, always include the following information:*

*(1) which version of what programming language is used*

*(2) sample runs of programs with sample test data*

*(3) instructions on how to run the programs*

*(Missing any of this information may result in deduction of points.)*

1. Suppose we wish to manipulate polynomials of the form  $p(x) = c_1 x^{e_1} + \dots + c_n x^{e_n}$ , where  $e_1 > e_2 > \dots > e_n \geq 0$ . (You can assume that  $n$  does not exceed 10 for the problem.)

(a) Write a program (called Program 1) that prints out a polynomial that the user has entered. For example, for the user to enter a polynomial  $p(x) = 5x^2 + 3x + 1$ , your program should ask the user to enter 5 2 3 1 1 0

Then your program should print out  $p(x) = 5x^2 + 3x + 1$

(b) Extend Program 1 to Program 2 that can accept polynomials from the user and add, multiply, and differentiate them. For example, given any two polynomials (e.g. 5 2 3 1 1 0 and 7 3 5 2 3 1 1 0) and given an addition operation, your program should produce:

$$p(x) = 7x^3 + 10x^2 + 6x + 2$$

(c) Specify an ADT (to be called *Polynomial Calculus ADT*) that allows the above operations.

(d) In addition to the addition, multiplication and differentiation, what other operations can be added to the Polynomial Calculus ADT to make it more useful?